IMPROVED FLOOR DRAIN WITH BUILT-IN SEDIMENT TRAP AND REMOVABLE GAS TRAP

FIELD OF THE INVENTION

The present invention generally relates to floor drain assemblies. The present invention is broadly concerned with an improved floor drain assemblies of the type used in industrial plants such as dairies, cheese plants, beverage, meat packing, canning, chemical, pharmaceutical, packaging plants and warehouses and in institutions such as laboratories and hospitals. The present invention is adapted for use in any location that has a concern with sewer gasses and germs and liquid borne contaminants More particularly, the invention pertains to such drain assemblies which include, beneath the drain inlet, a unique removable gas trap assembly operable to retain gases, such as sewer gas, within an exit pipe while allowing liquids and waste material, save for the small amount that serves as a aqueous barrier, to drain into the exit pipe. The exemplary embodiment of the present invention is cylindrical in shape and made of stainless steel, but can be any number of shapes and material and still achieve its technical advantages.

BACKGROUND OF THE INVENTION

Large industrial operations such as dairies, cheese plants, beverage, meat packing, canning, chemical, pharmaceutical, packaging plants and warehouses are faced with severe drainage problems. Similar issues arise in institutions such as laboratories and hospitals. The aqueous waste from such plants contains a high percentage of particulates of various sizes which must be discharged into the sanitary sewer system. The drainage system must address two concerns. First, the particulate-laden waste must be handled without clogging. Moreover, drain assemblies must be designed to prevent or at least minimize the escape of sewer gases and microorganisms from the sewage system back into the plant. For example, Lysteria contamination from floor drains is a concern at many meat packing houses.

Conventional drainage systems typically have a p-trap installed, often as dictated by applicable plumbing codes. Traps maintain a liquid barrier between the sewage system and the interior plumbing of a building. Without a trap to seal off plumbing fixtures, sewer gases, such as explosive methane gas can find their way into a building. 19th-century plumbing systems often

failed to have traps, and the resulting smell was the first notification that a dwelling had indoor plumbing.

Conventional gooseneck-type drain assemblies have proven to be troublesome in the context of industrial applications. These assemblies are prone to clogging, and they are susceptible to significant microorganism contamination. Furthermore, they are difficult to disassemble for maintenance and cleaning purposes. There is accordingly a need for an improved floor drain assembly, especially designed for industrial applications in order to handle large volumes of particulate-laden waste streams and still obtain the objectives of minimizing the escape of sewer gas and simple disassembly.

SUMMARY OF THE INVENTION

The present invention achieves advantages as a floor drain with built-in sediment trap for solids and removable gas trap assembly for trapping of gasses. The lid, optional basket, and gas trap assembly of the present invention are removable by hand. In one embodiment of the present invention the gas trap assembly is designed to be self aligning on the exit pipe within the drainage bowl and of sufficient weight to remain effective throughout the gas trapping process.

BRIEF DESCRIPTION OF THE DRAWINGS

For a more complete understanding of the present invention, reference is made to the following detailed description taken in conjunction with the accompanying drawings wherein:

Figure 1 is an illustration of the disassembled parts of a conventional floor drain assembly;

Figure 2 is a side view illustration of a conventional floor drain assembly showing the trap;

Figure 3 is a front perspective view of a conventional floor drain assembly;

Figure 4 is a cutaway side view of the present invention showing the various components and drainage flow;

Figure 5 is a view looking downward into one embodiment of the drain assembly of the present invention without the gas trap assembly or basket;

Figure 6 is a second view looking downward into the drain assembly of the present invention without the gas trap assembly or basket;

Figure 7 is a perspective view of the drain assembly of the present invention with the gas trap assembly, basket and lid nearby;

Figure 8 is a top perspective view of the gas trap assembly of the present invention;

Figure 9 is a bottom perspective view of the gas trap assembly of the present invention;

Figure 10 is a top view of the drain assembly of the present invention with the gas trap assembly located therein; and

Figure 11 is a top view of the drain assembly of the present invention with the gas trap assembly and basket located therein; and

Figure 12 is a top view of the drain assembly of the present invention with the gas trap assembly and basket located therein and the lid placed thereon.

DETAILED DESCRIPTION OF THE INVENTION

Figure 1 is an illustration of the disassembled parts of a conventional floor drain assembly made of a plastic or polypropylene material.

Figure 2 is a side view illustration of a conventional floor drain assembly showing trap 201. As seen in Figure 2, the trap 201 of drainage is the curved section of drain line that prevents sewer odors from escaping into the atmosphere. Disadvantageously, the trap 201 is fixed in position and cannot be easily removed to unclog the drain or to engage in maintenance.

Figure 3 is a front perspective view of a conventional floor drain assembly that has not been installed in a floor. The conventional drain assembly has a lid 301 with holes for liquids to flow and a trap 302 that serves as a aqueous barrier to gas.

Figure 4 is a cutaway side view of the present invention showing the various components thereof and the drainage flow path. As seen therein, the present invention comprises a main housing 401, whose inner wall defines drainage bowl 417, and a gas trap assembly 403. Optionally, a basket 402 to catch larger particulate matter can be placed upon the gas trap assembly 403 within drainage bowl 417. In the embodiment that includes the basket 402, the drainage path 410 of substantially all of the aqueous matter entering from the outer environment 423 into the drainage bowl 417 is through the basket 402, around the impervious outer top wall 414 and impervious outer lateral wall 416 of the gas trap assembly 403 into the inner cavity comprised of inner lateral wall 415 and inner top wall 412 of the gas trap assembly 403 and into exit pipe 405. Lid 406 is made to fit snugly within lip 409 so as to keep it from falling into drainage bowl 417. In addition, the main housing 401 of the present invention can be adapted to existing trench drains easier and more effectively

As can be seen in the exemplary embodiment, the main housing 401 has a radius (r) and lateral length (h) and is sunk into the floor 407 so as to create the substantially cylindrical drainage bowl 417 in the floor 407 with a volume of approximately pi*r*r*h. A preferred shape of the main housing 401, optional basket 402 and gas trap assembly 403 are cylindrical. Round shapes are less likely to promote bacteria growth whereas corners as found in parallelepipeds and prisms are breeding grounds for bacteria. Furthermore, round shapes are less likely to cause cracks in adjacent flooring materials, Nevertheless, if a non-circular drain shape is required, the main housing, gas trap assembly could be parallelepiped or prism and still covered within the scope of the present invention.

Figure 5 is a view looking downward into one embodiment of the drain assembly of the present invention without the gas trap assembly 403 or basket 402. Figure 6 is a second view looking downward into the drain assembly of the present invention without the gas trap assembly 403 or basket 402. As seen in Figures 5 and 6, exit pipe 405 extends into the drainage bowl 417 through aperture 418 in the bottom 408 of the main housing 401. The diameter of the aperture 418 is just slightly larger than that of the diameter of exit pipe 405 so as to allow a tight fit between the two. A seal or other impervious material can be added, welded or coupled between the outside lateral wall of exit pipe 405 and the aperture 418 at their point of contact so as to keep liquids from seeping between the two. As noted in Figure 4, exit pipe 405 is an open cylinder that extends into main housing drainage bowl 417, and gas trap assembly 403 is a closed cylinder. The diameter of gas trap assembly 403, including its extensions 801 (as seen in Figure 8), is less than the diameter of the main housing 401 so as to permit the gas trap assembly 403 to be freely inserted into the main housing 401 when the lateral side walls of each are parallel. The diameter of the exit pipe 405 is less than the diameter of the inner lateral wall 415 of gas trap assembly 403 so as to permit the open end of the gas trap assembly 403 to be inserted over the exit pipe 405 when the lateral side walls of each are parallel.

Referring back to Figure 4, gas trap assembly 403 is adapted to be positioned such that the closed end of gas trap assembly 403 is placed over the terminal end of exit pipe 405 that extends into drainage bowl 417. A set of members, referred to as inner fins 411, are attached, by weld in one embodiment, perpendicular to the inner lateral walls 415 and orthogonal to the inner top wall 412 of gas trap assembly 403. The inner fins 411 sit on top of the annular shaped terminal end 421 of exit pipe 405 and define a passageway between the inner lateral wall 415 and inner top wall 412 of gas trap assembly 403 and outer lateral wall of exit pipe 405. One skilled in the art would recognize that there are a variety of configurations that are operable to keep the trap elevated above the exit pipe and such alternative configurations are encompassed with the present invention. For example,

tabs can be fabricated on top of the exit pipe versus on the bottom of the trap, and tabs of another shape, such as round stock, long tabs or extensions on the trap can extend all of the way to the bottom of the bowl.

When viewing the cutaway side view of the main housing 401, exit pipe 405 and gas trap assembly 403, of Figure 4, it can be seen that when gas trap assembly 403 is seated over and on exit pipe 405, there is a length 419 of the lateral wall 415 of gas trap assembly 403 that extends below the terminal end 421 of exit pipe 405. This length extension 419, coupled with the passageway defined by the terminal open end 422 of gas trap assembly 403 and the bottom wall 408 of main housing 401, with length 420, allow aqueous matter to flow along the drainage path 410 into exit pipe 405 while also forming an aqueous barrier 404 between the exit pipe 405 and the outer environment 423.

Figure 7 is a perspective view of the drainage assembly of the present invention with the gas trap assembly 403, optional basket 402 and lid 406 nearby. As seen in Figure 7, the lid 406, optional basket 402, and gas trap assembly 403 are advantageously removable from the drainage bowl 417 defined by main housing 401, by hand.

Figure 8 is a top perspective view of the gas trap assembly 403 of the present invention. Optional members, referred to as outer fins 413, serve to support optional basket 402 and to define a passageway for aqueous material between basket 402 and around impervious outer top wall 414 and impervious outer lateral wall 416 of gas trap assembly 403. One skilled in the art would recognize that there are a variety of member configurations operable to support optional basket 402 and such alternative member configurations are encompassed with the present invention. For example: tabs sticking down from the bottom of the basket.

Handle 802 can be used to remove gas trap assembly 403 from the drainage bowl 417 defined by main housing 401 by hand. Any number of variations of the handle can be made and still fall within the scope of the present invention.

Figure 9 is a bottom perspective view of the gas trap assembly 403 of the present invention showing the inner lateral wall 415, inner top wall 412 and inner fins 411. As seen in Figures 4, 8 and 9, gas trap assembly 403 is designed to be self aligning and of sufficient weight to remain effective throughout the gas push-through process. In other words, the gas pressure required to push the column of water 404 in the gas trap assembly 403 up and "bubble" into the environment is less than the gas pressure required to lift the gas trap assembly. One skilled in the art would recognize that there are a variety of means for keeping gas trap assembly 403 aligned and secured to prevent gas push through and such alternative means are encompassed with the present invention. For

example the gas trap assembly can be secured by using the weight of the basket to hold it down, or mechanically fastening it with a fastener, such as a screw or bolt, or by physically held in place by a "twist-to lock" method wherein tabs sticking out from the trap assembly fit into grooves on the inside of the bowl and then the trap is twisted to "lock" it onto place.

Referring back to Figure 4, inner fins 413 are attached inside, and perpendicular to, the cylindrical inner lateral wall 415 and inner top wall 412. In one embodiment, inner fins 413 are welded to the inner wall 415 and inner top wall 412. Edges 901 of inner fins 413 rest upon the terminal end 421 of exit pipe 405. Figure 10 is a top view of the drain assembly of the present invention with the gas trap assembly 403 and basket located therein.

Figure 11 is a top view of the drain assembly of the present invention with the gas trap assembly 403 and optional basket 402 located therein.

Figure 12 is a top view of the drainage assembly of the present invention with the gas trap assembly 403, optional basket 402 located therein and lid 406 placed thereon.

As can be seen from the Figures and discussion herein, the present invention achieves a variety of advantages over conventional drain assemblies. No tools are required to disassemble and remove the gas trap assembly 403, optional basket 402 and lid 406 from the drainage bowl 417 of the present invention. The use of the present invention thus can contribute significantly to the cleanliness and hygiene at food plants and at institutions such as laboratories and hospitals. The present invention is less likely to clog up than standard p-trap drains because the sedimentation area and the gas drain are visible and accessible. Also, if the sediment trap does get full and clogs, then the sediment can be visually seen and physically removed before it enters the underground plumbing systems where it can cause other problems. Because the gas trap is removable, a plumber can expose the main drain line to perform maintenance. This reduces manufacturing downtime. The novel hand removable gas trap assembly 403 and removable optional basket 402 permit improved access to the drain for cleaning. As such, the present invention allows clogs to be cleared faster and with proper maintenance, can substantially prevent clogs from occurring. Furthermore, the optional basket can be customized and easily swapped to catch different sizes of particulate matter. One skilled in the art would recognize that the present invention can be fabricated in a variety of sizes and dimensions and such alternative sizes and dimensions are encompassed with the present invention. For example main housing drainage bowl 417 can be oversized to create a larger sediment trap. Also, the heights of drainage path 410 and inner fins 411 can be changed to increase or decrease the "effective trap height" which effects the gas trap's effectiveness. In other word, the

length of length extension 419 can be varied to increase or decrease the amount of pressure required to overcome the trap thus increasing or decreasing the effectiveness of the trap.

In one embodiment of the present invention, the lid 406, main housing 401, optional basket 402 and gas trap assembly 403 are made of 304 stainless steel. Stainless steel is a preferred material as it is resistant to acid, corrosion and staining. However, other materials, such as heavy duty cast iron bodies and high-grade nickel-bronze can be used to fabricate the present invention, The gas trap assembly 403 can be made of any material as long as the gas trap has enough mass to resist being lifted by the gas pressure, or is otherwise configured so as to resist the gas pressure through, for example, the use of twist-on or lock mechanisms. The gas trap minimum weight is calculated based on the dimensions of the drain. For example, a 4 inch drain and a 6 inch drain may have different requirements. One gas trap assembly 403 in an embodiment of the present invention weighs approximately fifteen (15) pounds. The drain is further designed to be forklift rated, meaning a standard forklifts can drive over it without damaging the drain. Furthermore, lid 406 can be a standard stainless Steel plate cover with holes, or can comprise a bar type grating. Furthermore, the steel plate cover can have a grate design that uses lettering, holes or different shaped apertures.

The numerous innovative teachings of the present invention are described with particular reference to an exemplary embodiment of a main housing and removable gas trap assembly made of stainless steel and both having a cylindrical shape. However, it should be understood that the exemplary embodiment is only one example of the many advantageous embodiments and innovative teachings herein. In general, statements made in the specification of the application do not necessarily delimit any of the various claimed inventions. For example, a drain according to the invention may be designed with a variety of dimensions. Moreover, some statements may apply to some inventive features, but not to others. Detailed descriptions of known functions and constructions unnecessarily obscuring the subject matter of the present invention have been omitted for clarity. The present invention is also described in terms of various functional components. It should be appreciated that such functional components may be realized by any number of hardware or structural components configured to perform the specified functions. For example, the present invention may be comprised in a number of shapes or made of a variety of materials. Additionally, the various components may be implemented in alternate ways, such as, for example, with or without a sediment trap or strainer basket. These alternatives can be suitably selected depending upon the particular application or in consideration of any number of factors associated with the operation of the drain or the location of the drain. Such general applications that may be appreciated by those skilled in the art in light of the present disclosure are not described in detail herein. These

and other changes or modifications are intended to be included within the scope of the present invention, as expressed in the following claims.